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A Close Look at Sand Pine

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INTRODUCTION

This Bulletin highlights the information presented at the Sand Pine Symposium held in Panama City, Florida on December 5-7, 1972. The symposium was sponsored by the Southeastern Forest Experiment Station, Florida Division of Forestry and the Florida Cooperative Extension Service. Authors' names appear in italics following their contributions. Their names and addresses are listed on Page 6 in case the reader wants to contact them for more details on subject matter or the source of material presented.

SAND PINE — AN OPTION WORTH EXPLORING

As forest managers know, most of the prime tree planting sites in the South are already in pine plantations. What's left are the tough, hard-to-plant sites and among these are the hot, dry sandhill areas in Florida, Georgia, North Carolina and South Carolina. The question is, what species will grow on such sites? Sand pine, for one, and research indicates that it does it better than any other southern pine species.

For many years, sand pine has been a dirty word among many foresters in the South. Accustomed to pines that grow straight and majestically tall, forest managers take one look at a sand pine and raise their hands in horror. Words vary at that point but "who needs 'em?" are among the kindest expressed.

Today, due to research findings over the past 10 years, it's time to take a closer look at the lowly sand pine. It offers a valid option to a forest manager with dry, infertile soil of excessively drained deep sands—sites now hosting scrub hardwoods, wiregrass or other unmerchantable vegetation. In fact, many such managers have nothing to lose. Soils of this type cover several million acres in distinguishable bands in the Southeast and occur in scattered patches in Texas, Louisiana, Mississippi and Alabama as well.

TWO VARIETIES

Sand pine comes in two varieties: Choctawhatchee which occurs naturally in northwestern Florida, and Ocala, a native of peninsular Florida. The most widely used feature distinguishing the two is cone behavior. As a rule, cones of the Choctawhatchee open and those of the Ocala remain closed. But this is not infallible. Probably the most reliable, easily recognized difference between the two varieties is the period during which staminate flowers ripen. In northern Florida, Ocala sheds its pollen from mid-December through mid-January while Choctawhatchee flowers ripen from late January through the month of February. —*Russell M. Burns.*

Take a Close Look. *These sand pine logs speak for themselves. They grow better on the hot, dry sandhill areas than any other southern pine species. Note the thin bark which makes sand pine highly susceptible to fire damage.*

USES AND MARKETS

Pulp and paper—The primary use of both varieties of sand pine has been in the pulp and paper field. Both varieties are suitable for pulping by several processes. The kraft sulfate process appears to be the one best suited to the reduction of sand pine to pulp because of the high yields and superior quality pulp produced by this method. When pulp yields are computed on a dry chip input basis, the yields from both varieties of sand pine are equivalent to those of slash and longleaf. However, when pulp yields are computed on the basis of volume (cord or weight), they are lower than those obtained from the same volume of slash or longleaf pines. This difference is attributable to the lower specific gravity of the sand pine varieties in comparison to that of longleaf and slash pines.

Pulping tests indicate that the sand pine can be satisfactorily mixed in various proportions with slash

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Choctawhatchee Sand Pine. *This variety can be used under the same structural conditions as shortleaf and loblolly pine. Its higher density makes it a likely candidate for the plywood industry.*

pine pulp to produce in some cases combination pulps with slightly improved properties over those of slash pine pulps alone. Because of its high alpha-cellulose content, the Choctawhatchee sand pine would be preferred over the Ocala sand pine in the dissolving pulp industries where rayon and nitrocellulose are made. Its high pentosans content also makes it more desirable in the manufacture of furfural.

Construction—A comparison of the specific gravity - strength ratios of Ocala sand pine and other species of yellow pine show that Ocala sand pine is equal to or better than the other yellow pine species in all properties except stiffness. Its low stiffness is associated with its low specific gravity and would limit the spans over which it could be used.

The Choctawhatchee sand pine has an average specific gravity about equal to that reported for shortleaf and loblolly pine, and could therefore be used under the same structural conditions as these species. The relatively low density of the Ocala sand pine indicates that the wood should be lighter, easier to handle, saw, and nail with less splitting. It also shrinks less, thus making it desirable for such products as siding and paneling.

Plywood—Sand pine could play a role in the rapidly expanding southern pine plywood industry, which is placing increasing demands on our forest resources. Because of the low density of the Ocala variety of sand pine, any veneer from this species would be restricted to inner ply use in a plywood panel. Choctawhatchee sand pine, on the other hand, because of its higher density could possibly meet the plywood standards and be used for face as well as core plies. Apparently these varieties could be cut into veneer without difficulty.

Particleboard—The relatively low density of the Ocala variety should make it very desirable in the manufacture of low to medium density particleboards. —*Michael A. Taras*

GROWTH COMPARISONS

Studies have shown that sand pine will produce more wood in a shorter time than other pines planted on droughty sandhills soils. One reason for this superior growth is that sand pine may be extremely efficient at extracting nutrients from the soil, and maintaining a desirable internal nutrient and moisture balance since it thrives where other species fail. Another reason is its ability to put on an early growth spurt in the spring as well as to have winter flushes of growth. It is the first tree to start height growth in the spring. It also makes a second spurt during the summer months with the coming of thundershowers.

—*Robert W. Britt*

In every case, test results so far point to the superiority of sand pine over other southern pine species on sandhill soils. For example:

—In a comparison test on the Chipola Experimental Forest in northwest Florida, the average Ocala was 20 feet taller and had produced about 25 times more wood than the average slash pine at age 12. At age 20, the Ocala plantings produced an average of 1400 cubic feet of wood per acre, whereas slash pine produced an average of only 64.4 cubic feet. In both cases, the pines had been released from overtopping hardwoods at various intervals after planting. On an average tree basis, Ocala produced from about 13 to 23 times more wood than the average slash.

—On an intensively prepared site, Choctawhatchee sand pine produced twice as much wood on an average tree basis and three times as much wood on an acre basis at age 10 as longleaf, slash and loblolly combined. Growth of neither slash nor longleaf is expected to approximate that of Choctawhatchee within a 25 to 40 year pulpwood rotation.

—In all cases, even the unreleased sand pines outgrew other pines that had been released following planting.

—Studies in Georgia and South Carolina showed that Choctawhatchee was clearly taller and larger than longleaf, slash and loblolly pines at age 7. The Georgia site was on an Alaga loamy sand and the South Carolina site was a Troup loamy sand. —*Russell M. Burns*

MANAGEMENT OF NATURAL STANDS

Management of natural stands of sand pine is done more or less on a "live and let live" basis, whether it be the Choctawhatchee or Ocala variety. Forest managers at Eglin Air Force Base in northwest Florida manage about 100,000 acres of Choctawhatchee sand pine, employing even-aged management. They make intermediate cuts at 10-year intervals when needed and harvest on a 40-year rotation age. They use both the clearcut and shelterwood method, but prefer the shelterwood system. Prescribed burning is used for fire protection and improving wildlife habitat, as well as a silvicultural tool. —*Robert W. Britt*

The Ocala National Forest practices little management, other than fire protection, on the Ocala variety.

From regeneration to harvest, there are no thinnings, intermediate cuttings, or fertilization programs. Due to the serotinous cones and the exclusion of wildfires, natural regeneration is very difficult, and for these reasons, forest managers rely almost entirely on artificial regeneration. The little natural regeneration that does occur is due to sunlight opening a few cones on downed tops. —*Murphy B. Price*

SEEDING AND PLANTING

Site preparation

Sand pine, unlike other southern pines, can survive and grow on sandhill sites without intensive site preparation. It can grow in a sandhills rough even without release from overtopping hardwoods. However, double chopping, rootraking or release from overtopping hardwoods does improve survival, height and diameter growth. Release applied within five years after planting is better than none at all, but it is not as beneficial as a release applied immediately after planting.

Care should be taken on these infertile soils to remove or destroy as little organic matter as possible when using mechanized methods of site preparation. Chopping has proved to be the most efficient mechanical method.

Sand pines are well-suited for planting on narrow strips prepared in the scrub hardwood-wiregrass rough. By varying the width of undisturbed rough and by meandering prepared strips so as to avoid straight rows, conversion to sand pine can be aesthetically acceptable, economically feasible and can aid in improving the wildlife habitat. —*Edwin A. Hebb, Russell M. Burns,* and *Clifford E. Lewis.*

Direct Seeding

The best time to seed sand pine in the sandhills of northwest Florida is during November, December, and the first half of January using repellent coated seed covered with 1/4 to 1/2 inch of soil. Fully 40 percent of planted seed can be expected to produce seedlings within one year under conditions similar to those encountered in two years of testing. Extending the seed planting season to include October or February is a gamble; chances for failure are about equal to those for success. Soil moisture, as measured by rainfall, is adequate for seedling establishment throughout most of the year, but the high temperatures normally experienced between March and September depress germination. As average daily maximum temperatures increase from 65° to 90° F. establishment drops sharply.

When planted on newly cleared deep sand soils, nursery transplants grew faster than direct-seeded seedlings, at least through plantation age 8. Differences in rates of height growth appear to decline with age, presumably because nutrients provided in the nursery are lost or diluted by tree volume. —*Robert D. McReynolds* and *Russell M. Burns*

Planting

Planting 1-0 seedlings during the dormant season is currently the most reliable method of insuring wanted stocking levels and uniform distribution. Choctawhatchee sand pine is the recommended variety to plant. First-year survival usually averages 10 to 40 percent higher than that of Ocala sand pine and, with Choctawhatchee sand pine, there is less likelihood of subsequent mortality to mushroom root rot.

Early survival of both varieties can be improved by planting dormant seedlings deep in the sand. This means obtaining nursery stock in January or February and planting it so that the lowest whorl of green needles is covered with soil.

Planting 500 to 550 Choctawhatchee sand pine per acre should provide 350 to 425 trees for harvest at a pulpwood rotation estimated to be between 30 to 35 years. Planting density for sand pine should be aimed at maximum pulpwood production; thinning to achieve this end does not appear practical in many cases. Depending upon site quality, an unthinned stand of 400 sand pine might be expected to yield as much as 2,775 cubic feet of merchantable pulpwood at plantation age 30.

If a thinning is planned, about 725 or 775 seedlings per acre can be planted. By age 20 the plantation should contain 600 to 650 trees. Thinning to remove every third row or every third row plus suppressed and diseased trees in the remaining rows will leave about 350 to 425 trees for a later harvest. Similar results can be obtained with Ocala sand pine but more seedlings will have to be planted to compensate for the higher rate or mortality typical with this variety. —*Russell M. Burns*

Planting Guidelines

—Plant only dormant 1-0 stock in January or February.

—Don't stack bales of seedlings.

—Don't store bales of dormant seedlings longer than one week.

—Set seedling deep, covering lower branches.

—For Choctawhatchee sand pine:
  —plant 500-550 seedlings per acre if no thinning is planned and trees will be harvested at about age 30.
  —plant 725-775 per acre if intermediate thinning is planned at about age 20.

—For Ocala sand pine:
—plant 900 per acre due to lower expected survival.
—don't plant far north of Florida

—On small acreage, underplant and release immediately from overtopping hardwoods or use prescribed chemicals to reduce scrub hardwoods prior to planting.

—On large acreages, double chop at prescribed intervals or chop in strips to remove overtopping hardwood competition.

Multi-level Stand. *Natural regeneration is possible with Choctawhatchee sand pine because its cones open freely. This stand is located on lands of Eglin Air Force Base in northwest Florida.*

FERTILIZATION

The mere fact that sand pine thrives on sandhill soil where other species fail suggests that it may be extremely efficient in extracting essential growth elements from the soil and maintaining a desirable internal nutrient and moisture balance. It follows that sand pine growth may benefit if the nutrient supply is increased, and fertilization tests have borne this out.

Both varieties of sand pine have responded to fertilizer treatments. In general as the amount of fertilizer material applied increased, growth increased but not necessarily in proportion to the increase in fertilizer application. Ocala has shown a greater height growth response than Choctawhatchee, especially to the higher rates of fertilization. Diameter growth of Choctawhatchee in response to fertilization has increased more rapidly than that of Ocala with a resultant increase in total volume. Frequent light applications of fertilizer have produced a greater growth response than a single heavy application of the same materials, which suggests a need for slow release sources of nitrogen and phosphorous for sandhills fertilization.

It appears entirely possible then that after a sand pine plantation has been fertilized the trees will be capable of recycling a substantial portion of the added nutrients within the trees or stand, and tree growth will be increased for a major portion of a plantation rotation. *—R. H. Brendemuehl*

RISKS

Insects

There are four serious insect enemies of sand pine: bark beetles; reproduction weevils; sawflies; and the aphids, scales and mealy bugs. Of these, the bark beetles—both the Ips and the black turpentine—will probably cause the most volume loss due to mortality. Although the black turpentine beetle prefers the other pine species, it has attacked larger sand pine. The bark beetles have been found attacking and killing sapling sized to mature sand pines. Reproduction weevils are primary killers of seedlings and small saplings. Larger stumps and roots are required for successful development of the weevil; so as we practice shorter rotations suitable host material may not be present, therefore eliminating or greatly reducing the weevil problem.

The various species of sawflies will be most important from the growth loss standpoint. The sand pine sawfly feeds exclusively on sand pine, attacking small sapling sized to mature timber. This species appears to be confined to the Choctawhatchee race of sand pine, and to date has been found only in Walton and Okaloosa counties in northwest Florida. Several species of aphids and scales have been observed on sand pine, with large populations frequently occurring on individual or small groups of trees. No mortality has been observed, but some growth loss certainly occurs. *—Charles W. Chellman*

Diseases

The most serious disease presently limiting the successful establishment of sand pine plantations, particularly the Ocala variety, is mushroom root rot. This disease may be severe in areas where hardwood stumps and root debris are left in the soil after site preparation. The pathogen readily colonizes the hardwood debris and attacks the young sand pine at points of root contact. Losses may be avoided by completely removing hardwood debris during site preparation; however, this may not be economical. Field observations suggest that the Ocala variety is more susceptible than the Choctawhatchee variety, but conclusive evidence is still lacking. If, from a silvicultural standpoint it is desirable to plant Choctawhatchee seedlings instead of Ocala, there are no pathological reasons at present to discourage it. *— Eldon W. Ross*

Fire

Wildfire is a paradox to Ocala sand pine. Heat from a

killing fire opens up the stubbornly closed cones, which then release tremendous quantities of seed. But the trees are killed. Strike wildfire as an acceptable form of forest management!

Beware of spring. This is the season when the resin and fat content of Ocala sand pine needles reaches its yearly high, coinciding with peak values of heat content. Moisture content of both new and old needles is also at its lowest yearly level. When fuel and weather conditions are ideal for burning, spring wildfires in dense sand pine stands crown easily and are difficult to control. During many months of the year, however, conditions are less favorable for burning and stands of sand pine are not considered fire hazards.

Unfortunately, prescribed fire has not been a particularly effective tool in Ocala sand pine management. There are, nevertheless, a few instances where prescribed fire is applicable—mostly in west Florida. On the Eglin Air Force Base, burning for hazard reduction in Choctawhatchee sand pine is a common practice during the winter months. Understory fuels associated with sand pine are relatively light and produce low-intensity fires at this time of year. In the more open stands, the fires often help to prune some of the lower limbs During the drier times of the year, it is difficult to maintain low-intensity fires and excessive damage and kill are more likely to occur.

Except for these special cases, prescription burning is not currently recommended except possibly for slash disposal purposes in clearcut areas to be regenerated artificially.

The fire problem in natural stands of Choctawhatchee sand pine is not nearly as critical as it is in stands of the Ocala variety. Nevertheless, a potentially dangerous fire situation may exist where either variety is used in extensive plantations. —*Robert W. Cooper*

Ice and Cold

As sand pine is extended to more northern sites the threat of glaze damage becomes more serious. Surveys have shown that damage from low temperature itself seems remote if the Ocala variety is avoided; the principal threat is mechanical damage from heavy deposits of ice. The threat to sand pine, all things considered, should be no greater than to slash pine. In establishing sand pine stand, crowding should be guarded against, for it makes the stands susceptible to ice damage. With pulpwood the final product, management should emphasize proper spacing, with a goal of 75 square feet per tree and no thinning. —*Edwin A Hebb*

WILDLIFE AND RECREATION

The sandhills are unable to sustain large populations of wildlife in most cases, but they provide habitat for many species due to the interspersion of a wide variety of vegetation types. The highest populations of deer in Florida are found in the sandhills, however.

Sand pine can compete successfully with native vegetation, therefore site preparation can be eliminated or the intensity reduced to maintain native vegetation for other uses. The sandhills offer good potential for development of recreational opportunities and increased wildlife populations along with timber products.

The following guidelines will help accomplish such goals:

1. If site preparation is considered essential, strip chop narrow rows for planting pines, leaving intervening unchopped strips of varying widths. This not only maintains much of the native vegetation, but also increases pine growth and reduces site preparation costs.

2. Plant Choctawhatchee sand pine in extremely wide-spaced rows (20' or more) to reduce planting costs and maintain more native vegetation. This plus strip chopping will also enhance the aesthetic appearance of the site.

3. Where timber stand improvement is practiced, leave about 5 to 10 large, mature oaks per acre to maintain acorn production for wildlife.

4. When preparing sandhill sites for planting, leave strips or scattered blocks (1-5 acres) of oaks throughout the planting area. This will maintain both food and cover for deer along with special niches for other wildlife.

5. When planting rows of trees or leaving strips of oaks, avoid making straight lines by following a meandering pattern for a better aesthetic appearance. —*Clifford E. Lewis*

THE FUTURE

Soon, improved sand pine seedlings grown from seed produced in state, federal, and industrial seed orchards will be available for outplanting. Improvements in form, quality and yields will make sand pine an even better prospect for sandhill plantations.

Species of High Tolerance. *Because of the high tolerance and competitive nature of sand pine, site preparation is not a necessity when artifically regenerating Ocala or Choctawhatchee sand pine. This tree prospered, eventually outgrowing the hardwood overstory.*

SAND PINE SCOREBOARD

How sand pine compares with other southern pine species

Planting costs on sandhills	Choctawhatchee far less because can plant far fewer seedlings due to better survival and less need for site preparation. Ocala costs more than Choctawhatchee but site preparation less than other species.
Seeding success	Seeding of sand pine on sand hills similar to seeding of other species on other sites.
Survival after planting on native sand pine range	Choctawhatchee equal to or better than slash or loblolly, better than others. Ocala below all except longleaf.
Survival after planting outside natural sand pine range	Choctawhatchee similar to loblolly and slash. Ocala below all but longleaf in both Georgia and South Carolina.
Height growth after 15 years from 1-0 planting stock on intensively prepared sand hills	Ocala was twice height of longleaf, leading competitor among other species. Choctawhatchee led all but Ocala.
Volume growth after 15 years from 1-0 planting stock on intensively prepared sand hills	Choctawhatchee produced five times more cubic feet per acre than slash, leading competitor among other species. Ocala behind Choctawhatchee because of lower survival but far ahead of others.
Response to fertilization on sand hills	Better than other southern pines. Choctawhatchee better than Ocala on volume growth, below on height growth.
Resistance to ice and cold	Choctawhatchee no worse than slash, Ocala is poorest of all and suffers from cold and ice.
Resistance to fire	Depends on season of year; almost fire-proof at times, highly flammable at others.
Disease susceptibility	Very low but may increase as sand pine is planted outside its native range. Only serious threat is mushroom root rot, which kills Ocala variety.
Insect enemies	Fewer than most southern pines. Sand Pine Sawfly exclusively attacks Choctawhatchee.
Use for pulp and paper	By volume would produce less pulp than slash or longleaf, more than loblolly or shortleaf. Lower lignin content reduces disposal problem. Best suited to sulfate process. Choctawhatchee contains relatively high proportion of extractives.
Use in construction	Strength is equal to or better than others. Stiffness is below others——use as beam limited to shorter spans.
Use for siding and paneling	Good. Shrinkage is less than other species.
Use for particleboard	Desirable for low to medium density boards.

INFORMATION SOURCES

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